Peru
Geothermal Energy Market Overview

April 2021

Key Facts

- No current installed geothermal power generation capacity
- Geothermal resource potential estimated at around 2,900 Mwe
- The best development prospects are located in the South of the country
- Only concrete development at the moment for two projects by national subsidiaries of Energy Development Corp. (EDC)

Abstract:

Peru is one of the South American countries with the greatest geothermal potential because of its location inside the Pacific Ring of Fire. According to the Master Plan for the Development of Geothermal Energy in Peru, there is a geothermal potential of 2,860 MWe nationwide for electricity production. The best geothermal prospects are located in the southern region and are associated with active volcanism. Misti, Ubinas, Huaynaputina, Ticsani, Sara Sara, Sabancaya, Coropuna, Ampato, Tutupaca, Yucamane, Purupuruni and Casiri are the main active volcanoes. The evaluation of the geothermal potential started in the 70's with the national inventory of thermal manifestations, executed by the Mining and Metallurgical Geological Institute (INGEMMET). The development of the geothermal industry in Peru has not had a significant advance, in spite of having a specific regulation for geothermal electricity generation like the Organic Law for Geothermal Resources, Law Nº 26848 and Law for the Promotion of the Investment in Electricity Generation using Renewable Energy published on May 2008. There is no project in an advanced exploration phase, with drilled wells and a confirmed resource. The National Energy Policy for Peru 2010-2040 (approved by Supreme Decree N° 064-2010-EM) promotes energy efficiency and the development of renewable energy technologies at local, regional and national levels.

Country Overview

Peru is a country located in the continent of South America bordered in the north by Ecuador and Colombia, in the east by Brazil, in the south-east by Bolivia, in the south by Chile, and in the south and west by the Pacific Ocean. Peru has a population of 33.3 million as of 2021 and a size of 1,28 million km2. Lima is the capital city as well as the commercial and industrial centre of Peru. According to official data from the World Bank and projections from Trading Economics, the Gross Domestic Product (GDP) in Peru was USD 226.85 billion in 2019 which represents 0.19 percent of the world economy. As of May 2019, Peru maintained 14,900 MW of renewable energy generation capacity, based on a mix of contributions from hydroelectric, wind, biomass, and solar facilities.

The Country's Energy Market

Peru has a high potential for renewables such as hydro, wind, solar, geothermal and biomass. The government identified the development of electricity from renewable energy sources as a public necessity of national interest. A National Renewable Energy Development Plan is established by the government to be funded by the Annual Budget Law, external debt operations, direct investments and contributions from international institutions. As of September 2020, the gross electricity generation in Peru is around 30.9 TWh with a maximum confirmed demand of 4.3 GW, including energy exports to neighboring countries. 56% of the power in Peru is generated by thermal plants using gas or oil and 44% of hydroelectric plants together with other renewable sources. Even though installed capacity is evenly divided between hydroelectricity and conventional thermal energy, 62.9% of Peru's total electricity generation generally comes from hydroelectric facilities. Conventional thermal plants generally operate only during peak load periods or when weather factors dampen hydroelectric output, thus generating 2.8% of the total electricity generation. A recent investment by the Peruvian Government in gas power plants has resulted in the generation of 31% of total energy generation. Finally a minimal 3% of total energy production is generated by carbon power plants.

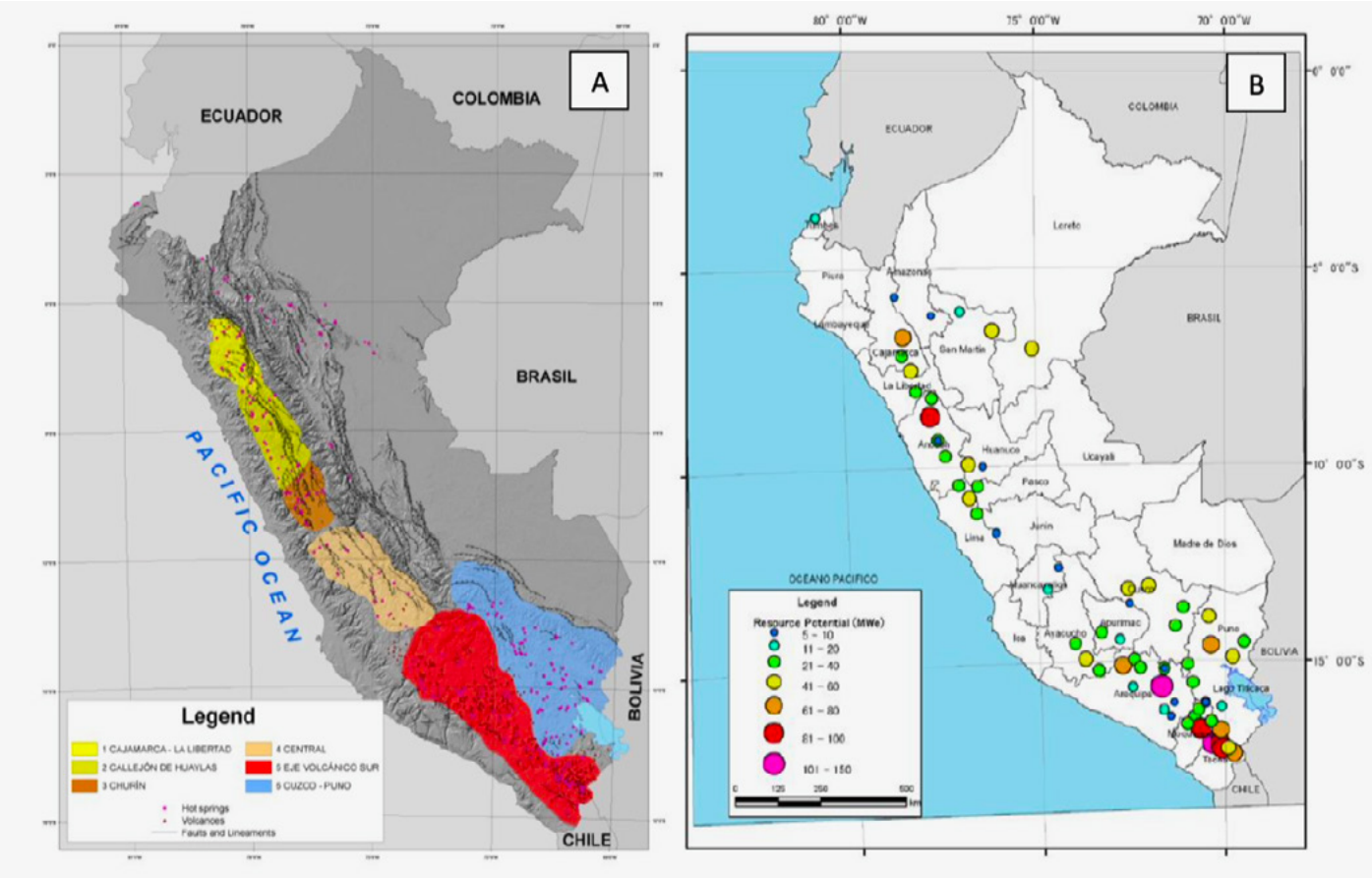

Image: - A) Geothermal regions of Peru (Vargas and Cruz, 2010). B) Map of geothermal power potential of Peru (MEM-JICA, 2012).

Geothermal Resources and Potential

Because of its location inside the Pacific Ring of Fire, Peru is one of the South American countries with the greatest geothermal potential. The Pacific Ring of Fire occurs in the subduction process from the Nazca Plate into the South American one, which has controlled the geological evolution of the Peruvian territory along the time from the Mesozoic up to date. As a consequence, magmatic and tectonic processes have allowed the development of geothermal reservoirs in these regions. Geothermal assessment in Peru started at the beginning of the 70's which was carried out by the Mining and Metallurgical Geological Institute (INGEMMET) in cooperation with international institutions with the national inventory of thermal manifestations, which were focused mainly on the Southern Peruvian Volcanic Range. Six geothermal regions throughout the country have been delimited according to the information generated and updated. Among them, region 5 was found to be the most promising region due to its characteristics of medium to high enthalpy geothermal areas, associated with active volcanism. Based on the Master Plan of Geothermal Energy Development of the country completed in 2012, a geothermal potential of 2,860 MWe is estimated. From this potential, 420 MWe were found in 5 geothermal zones (Calientes, Borateras, Chungara-Kallapuma, Ancocollo, Tutupaca) in the region of Tacna. INGEMMET continued his evaluation and characterisation assessments for the geothermal resources, by implementing some instrumentation measures for exploration works (laboratory equipment, acquisition of magnetotelluric equipment, etc.) after these studies. Extra geothermal spots have been identified in Peru since 2015 in the geothermal zones of Pinaya, Jarpaña, Atecata, and Coline in the Puno region which collectively have a potential of 63 MWe, and since 2017 in Paucarani (estimated potential of 72 MWe), Casiri-Kallapuma (estimated potential of 135 MWe), Kovire (Borateras) in the Tacna region. In spite of multiple geothermal spots being identified, today none of them are not developed.

Regulatory framework

energy market, geothermal market & development

The increasing energy demand in the nation has pushed the government to formulate policies and regulatory frameworks. The regulatory framework in Peru is very rich in laws and regulations that promote renewable energy, including geothermal. A law No.100211 that promotes investment in electricity generation from renewable energy sources as a national priority including geothermal, biomass, wind, solar, tidal, and hydropower approved in 2008, is one of the most important laws.

This law, together with its regulation, provides some incentives to private energy producers such as a fixed guarantee price established through public auctions, supply energy contracts up to 20 years, and priority in the energy dispatch and electricity network access. Besides, another law (Law No. 1058) was also approved in 2008 to promote investment in the electricity generation activity with other water and renewable resources.

Moreover, Cogeneration Regulation No. 037-2006-EM that establishes the requirements and conditions for qualifying cogeneration plants involved in the electricity market approved in 2006. The Organic Law on Geothermal Resources (Law No.26848) promulgated in July 1997, and its Regulations which were passed in 2006 later replaced in April 2010 (Supreme Decree No. 019-2010-EM10) and modified in May 2013 (Supreme Decree No. 015-2013-EM11) is the law that directly promotes geothermal development. The law and the subsequent regulations were approved with the objective of allowing private investment in developing geothermal.

As geothermal resources are mostly located in natural protected areas, there are additional laws and regulations that apply such as the Protected Natural Areas Law No. 26834, and its regulations (Decree No. 038-2001-AG). With a main objective to have a diversified energy mix for long-term plans with emphasis on renewable energy and energy efficiency, a new national energy policy for 2010-2040 was approved by Supreme Decree (No. 064- 2010-EM3) in November 2010. The important feature of the regulatory framework in Peru is still in the initial phase of application and subject to improvements and modifications.

Tasks related for setting policies and regulations on electricity and granting concessions is executed by the National Electricity Office (DGE - Dirección General de la Electricidad), under the Ministry of Energy and Mines (MEM). The office is also responsible for elaborating generation and transmission expansion plans and has to approve the relevant procedures for the operation of the electricity system.

The Energy and Mining Investment Supervisory Body (OSINERGMIN - Organismo Supervisor de Inversión en Energía y Minería) is in charge of enforcing compliance with the Electricity Concessions Law (LCE) of 1992 and is also in charge of ensuring the electricity public service. OSINERG is also the body responsible for enforcing the fiscal obligations of the license holders as established by the law and its regulation. The Office for Tariff Regulation (GART) is in charge of fixing generation, transmission and distribution tariffs and the tariff adjustment conditions for the end consumers.

Geothermal Energy Utilisation today

Today, geothermal energy is only being utilised for direct use purposes only unlike the neighbour nations of Chile and Colombia which started to have electricity from the sector. Due to its location in areas of vast tourism attractions, geothermal resources have been traditionally used for recreational and touristic purposes in Peru. However, the use of these resources in Peru is still mainly limited to entertainment and balneology in places such as Baños del Inca in Cajamarca, Callejón de Huaylas in Huaraz, Churín in Lima, Calera in Arequipa and Aguas Calientes in Cusco. Today, the use of geothermal sources in balneology activities (hotels, spas and recreation) in Peru has increased, from the usage of traditional techniques to the construction of hotels located in Cusco (Aguas Calientes) and Arequipa (Colca Canyon).

Geothermal Market & Industry

In Peru electricity generation and distribution activities are carried out by both state-owned and private companies while the whole transmission construction is conducted by private companies. In 2008, 14 companies generated electricity for the market and four of them accounted for 72.5% of the total capacity. The companies are; EDEGEL S.A.A. (produces 1,574MW), Electroperú S.A. (ELP) (produces 1,032 MW), Energía del Sur S.A. (ENERSUR) (produces 725 MW) and EGENOR (produces 522 MW). Private companies dominate the generation sector. In terms of participation, state companies hold 30% of generation capacity, with the remaining 70% in private hands. The largest transmission company in Peru is the Colombia-based ISA Group, which controls over half of the transmission grid in the country through its subsidiaries Red de Energia del Peru and Interconexion Electrica (ISA). Public distribution companies supply electricity to 56% of the existing clients while the remaining 44% is in the hands of private companies.

Current Project Development

Although some companies have had concessions for the usage of geothermal resources in Peru, currently no project has entered detail exploration phase like drilling nor construction activities of geothermal power plants yet. However, Philippines headquartered Energy Development Corporation (EDC) operating through its subsidiary companies Geotérmica Quellapacheta Peru S.A.C. and EDC Energía Verde S.A., have increased efforts on development efforts for the Quellapacheta projects in the Calacoa-Putina geothermal field (near the Ticsani Volcano) and Achumani in the Chivay geothermal field - Pinchollo (located near the Huallca Huallca Volcano, in the Colca Valley). Exploration activities, such as geological, geochemical and geophysical studies carried out by EDC in these areas led them to conclude the first phase of the Peruvian administrative process and have received a grant from a multilateral organisation in order to start its exploration drilling campaign for a 100 MWe.

Outlook

By 2030, Peru's energy development strategy intends to triple the share of renewables to account for about one-sixth of all installed generation capacity. The government of Peru set a road map for stepwise Geothermal development. According to the milestones mentioned in the master plan study done by JICA in 2012 for Geothermal development, 820 MWe and 1,000 MWe of electricity in 2025 and 2030 respectively were to be achieved from development at thirteen hot spots based on resource estimates.

Sources

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